# Urma Digiset 5

## USERMANUAL

Version 1.0 e

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# 1 Important notes

## 1.1 Delivery schedule

The Digiset 5 imaging system is supplied with the following components:

- Digiset 5 measuring unit
- Zero point mandrel
- Power cord
- TCAM2 with integral electronic analysis devices and colour LCD
- Telecentric CMOS camera
- Telecentric LED light
- Desk top power pack
- USER manual on CD-ROM
- Quick start manual (outside of the wood box)
- Dustcover
- Certification of conformity and warranty certificate

Please check the contents of the package directly after delivery.

Please contact us immediately if the contents as described above are not correct.
In case of transportation damages take immediately contact with the forwarder.

## 1.2 Purpose

The Digiset 5 is a standalone, complete imaging system for automatic measuring of contours, especially for automatic measuring of tool cutting edges to calculate relevant geometrical data.

The object to be measured is displayed as a live picture on the bright, 10.4” screen as well as the geometrical data automatically calculated for the object and the readings of the measuring systems connected.

The Digiset 5 has a simple menu control system, just like the ones used in common Office applications, operated with a PS2 mouse. All functions can be selected simply and easily using the menu bar.

# 2 Safety instructions

## 2.1 General safety instructions

The following instructions must be carefully observed before installing and commissioning the TCAM2 imaging components, CMOS camera and light and if necessary the counter module.

1. Imaging components may only be installed by specially trained personnel.
2. Use the optional power pack adapted for the components' connection data to supply power to the equipment.
3. The guarantee does not cover any damage to the imaging components caused by using your own power supply.
4. The TCAM2 must be connected last in order to protect system components from damage.

Keep this user manual carefully for later use and observe the following safety and operating instructions.

1. Do not expose the Digiset 5 to direct sunlight.
2. Do not expose the Digiset 5 to excessive damp and do not pour fluids over the equipment.
3. All maintenance work must only be carried out by authorized customer service personnel.

# 3 Compatibility statement

| | |
|---|---|
| Manufacturer: | Urma AG, Werkzeugfabrik<br>Obermatt 3<br>CH-5102 Rupperswil/Switzerland |
| Name of unit: | UrmaDigiset 5 |
| Unit type: | Image processing |

## 3.1 Electromagnetic compatibility (EMC)

The TCAM2 meets the conditions of standards EN 550011 and EN 50082-2.

These threshold values give sufficient protection against dangerous electromagnetic radiation for the environment. This applies as long as the product has been fitted and used in accordance with the instructions. It is also necessary for all cables to the TCAM2 to be shielded and connected properly. The electronic analysis unit must also be shielded and earthed.

Operating with incorrectly shielded cables can lead to electromagnetic interference.

All changes or modifications that are not expressly approved by the manufacturer will lead to the operating licence being null and void.

# 4 SETUP INSTRUCTIONS

## 4.1 Unpacking and start up

The device is delivered in a wood box. The transport holder (red screw head) is located on the top side of the measurement tower.

### 4.1.1 Unpacking

1.1 Loosen the top cover of the wood box and lift it up. (Pic. 1)

Pic. 1

1.2 There are two compartments inside the box filled with accessories. Carefully unpack these accessories first. (Pic. 2)

Pic. 2

1.3 Loosen the locking screws at the bottom of the wood box (marked with black colour)

1.4 You can now lift the frame of the box vertically up over the measurement tower. (Pic. 3)

1.5 Take away the protection film and check the device. Report any visible transport damage without delay to your supplier or shipper.

1.6 Lift the device up with two persons.

Pic. 3

**Don’t touch the camera or light to lift up.**
**This may instantly damage the unit!**

1.7 Place the device on a flat, stable base.

### 4.1.2 Assembling and setup of Digiset 5

1. Check the handwheel for the x-axes is dissassembled.
2. Get a piece of wood or a similar, strong block (about 100x100x200mm / 4x4x8 in)
3. Carefully flip the Digiset as shown in Pic. 4 (make sure no parts get damaged)

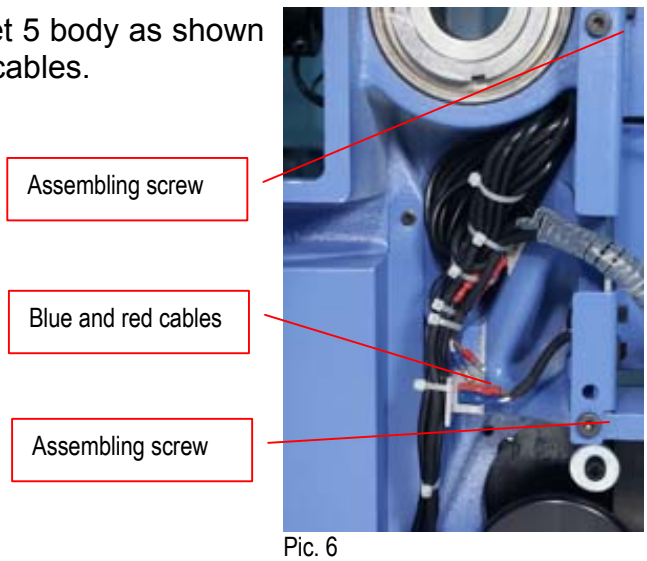
Pic. 4

4. Take the metal frame and put in the cable binder as shown in Pic. 5 and 5a (it is difficult to put them in after mounting the metal frame)

Pic. 5a

Pic. 5

5. Assemble the metal frame to the Digiset 5 body as shown in Pic. 6 and connect the blue and red cables.




Pic. 6

6. Flip the Digiset to its normal horizonta position and mount the screen to the metal frame and connect cables (Pic. 7 and 7b) according to the number tags.

Pic. 7b

Pic. 7

7. Check once again whether all cables are pluged correctly.

Pic. 7

8. Connect the unit with the transformer and put the power cord to the power supply
9. Remove the security screw from the top of the tower
10. Switch on the unit and start with the basic settings

**NOTE:**
**Never place the device in the immediate vicinity of the following machines and devices:**

- **EDM machines**
- **Electrical welding equipment**
- **Circuit breakers and switches**
- **Electrostatic painting systems and similar fixtures**

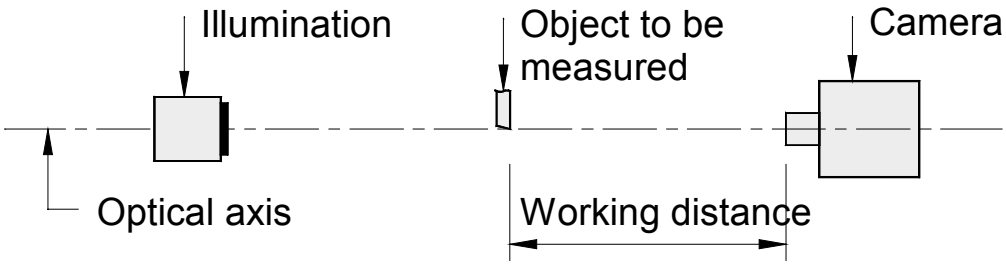
## 4.2 Calibration of Presetter

### 4.2.1 Set the camera's working distance

The working distance is defined as the distance between the front edge of the camera tube shield and the object to be measured, for example a tool cutting edge.

This measurement is preset by the design and the production tolerances of the camera tube shield (lens).

The working distance must be set following the instructions in the enclosed calibration log with a permissible tolerance of 100 ± 0.1mm. (3.937 ± .004")




*Aligning the camera and the lamp*

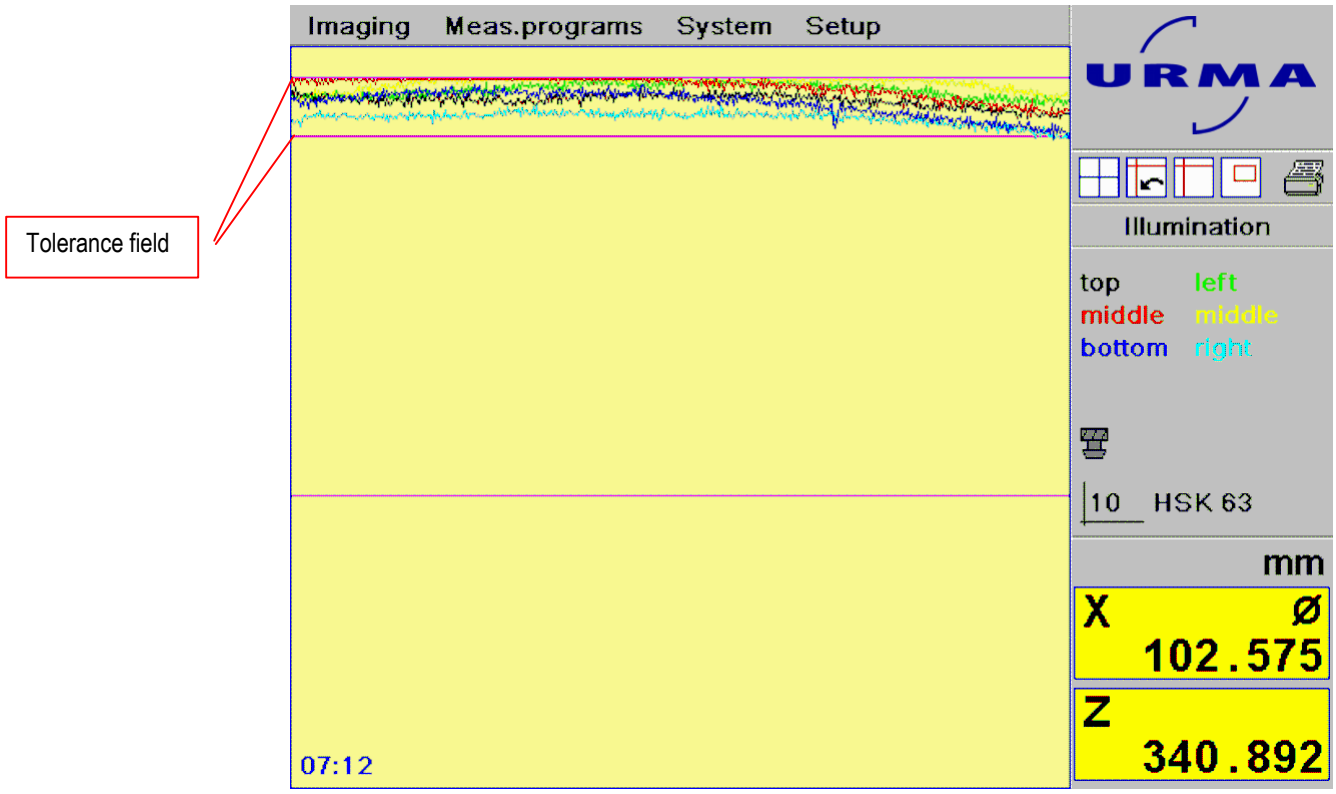
### 4.2.2 Check illumination

After the working distance is checked, the homogeneity and brightness of the illumination must be set. For this, you **must not have** anything in the camera's visual field. To check the illumination the greyscales are checked in the camera's horizontal and vertical alignment on both edges of the image as well as the middle of the image and the results shown on 6 lines.
The illumination reaches its optimum setting if these lines are as horizontal as possible and within the horizontal tolerance range marked by 2 purple lines.

You access the operating mode for setting the illumination using the following menu steps:

| Main menu | | Sub-menu 1 | | Sub-menu 2 |
|---|---|---|---|---|
| Setup | ⇨ | Imaging | ⇨ | Illumination |

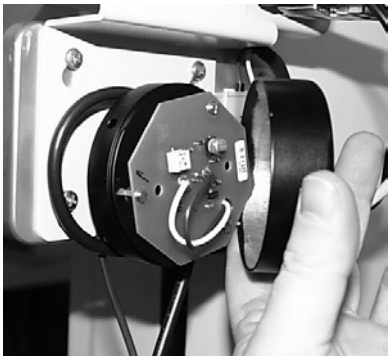
The TCAM2 displays the following image with 6 grey scales (illumination lines):

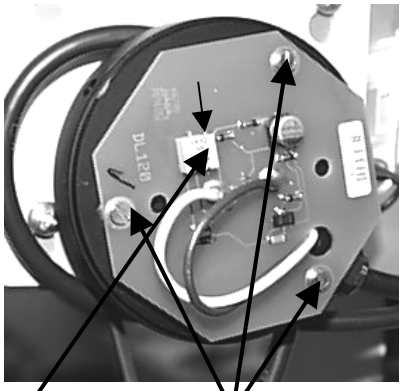



Procedure:

1. Select the illumination check with the "Illumination" operating mode. The horizontal tolerance field appears with the illumination lines. "Illumination" appears in the status window.
2. If not all 6 greyscale lines on the LCD are inside the tolerance field, you have to adjust the light source. Remove the cover of the light source as shown on the picture below.

3. If the greyscale lines are not horizontal you have to adjust the position of the light to the optical axis. For this you unscrew the 3 slotted-head screws until you can move the whole print. On the screen you will see what the movement of the print will cause with the greyscale lines. You move the print until all greyscale lines are horizontal.






4. If the greyscale lines are horizontal but not within the tolerance field, you can increase or reduce the intensity of the light on turning the little screw on the potentiometer.

5. Put back the cover and exit the illumination check with ESC or by selecting another operating mode.

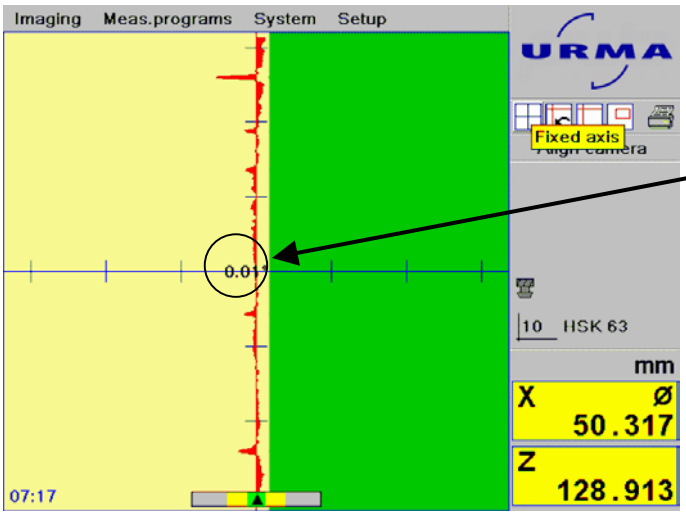
### 4.2.3 Align camera

When aligning the camera you must ensure that a known straight contour running parallel to the vertical axis of your system also runs parallel to the vertical axis of the cross hairs in the TCAM2.

You access this operating mode using the following menu steps:

| Main menu | | Sub-menu 1 | | Sub-menu 2 |
|---|---|---|---|---|
| Setup | ⇨ | Imaging | ⇨ | Align camera |

The TCAM2 then displays a histogram that shows the deviation away from the vertical axis.




The displayed value for the angle should be less than 0.02 °

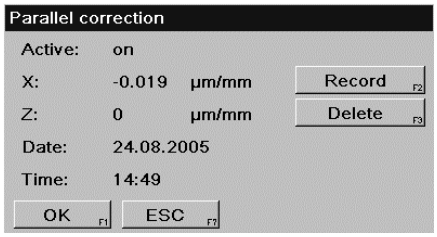
Procedure:

1. Set the master mandrill on the screen it is not necessary to set in the centre.
2. Select the "Align camera" operating mode. The TCAM2 then goes into the "Align camera" operating mode and you will see a histogram along the vertical axis of the cross hairs. "Align camera" appears in the status window.
3. Turn the camera on its support around the optical axis until the histogram has the smallest possible deviation.

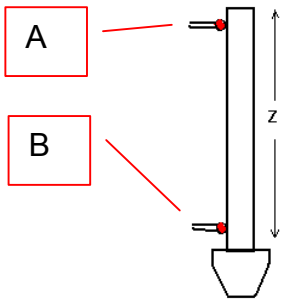
### 4.2.4 Adjust X- and Z-Parallelity

You access this operating mode using the following menu steps:

| Main menu | | Sub-menu 1 | | Sub-menu 2 |
|---|---|---|---|---|
| Setup | ⇨ | Corrections | ⇨ | Parallel correction |

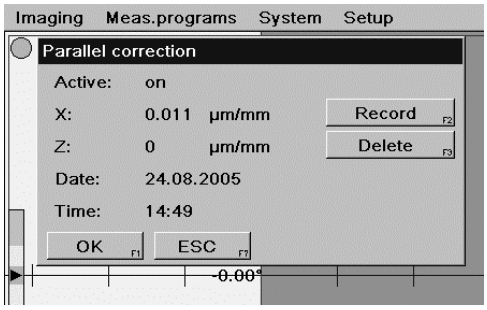



The axis of the calculated correction values is automatically allocated by the system with parallel correction.




**X-axis parallelity**

1. Insert calibration bar into the Digiset spindle
2. Switch on the Digiset
3. Move the measuring arm in both axis
4. Move the measuring arm to the upper position (A)
5. Click *SETUP* on the menubar; → *Corrections* → Parallel correction
6. The window “Parallel correction” must show “on” for Active. Otherwise change it
7. Click on “Record”
8. the screen shows “1. Point”
9. Measure the first point (A) and click OK
10. Move the measuring arm to its lower position (B)
11. Measure the second point and click OK
12. click OK to complete the procedure.

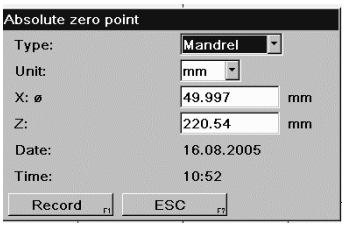



The parallelity for the Z-axis is installed in the factory.

### 4.2.5 Set absolute zero point

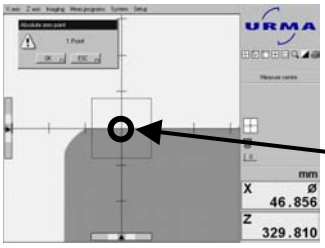
You access this operating mode using the following menu steps:

| Main menu | | Sub-menu 1 | | Sub-menu 2 |
|---|---|---|---|---|
| Setup | ⇨ | Corrections | ⇨ | Absolute zero point |

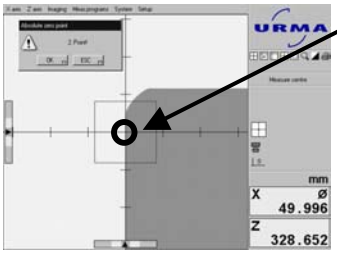



The absolute zero point is the reference point for all stored tool references.
For this reason, before saving tool references, it is necessary to store the absolute zero point as follows.

1. When you click on the menu point “absolute zero point” it will appear the window on the left. Enter the known dimensions of the master mandrill.
2. Press on the Record bottom on this window and it will open a new Window showing “1.point”




3. Move the horizontal line of master mandrel to the center of the reticule ( You are in the “measure centre” mode ) to measure the length. Click “OK”.
4. Move the vertical line of the master mandrel to the center of the reticule to measure the diameter. Click “OK”.



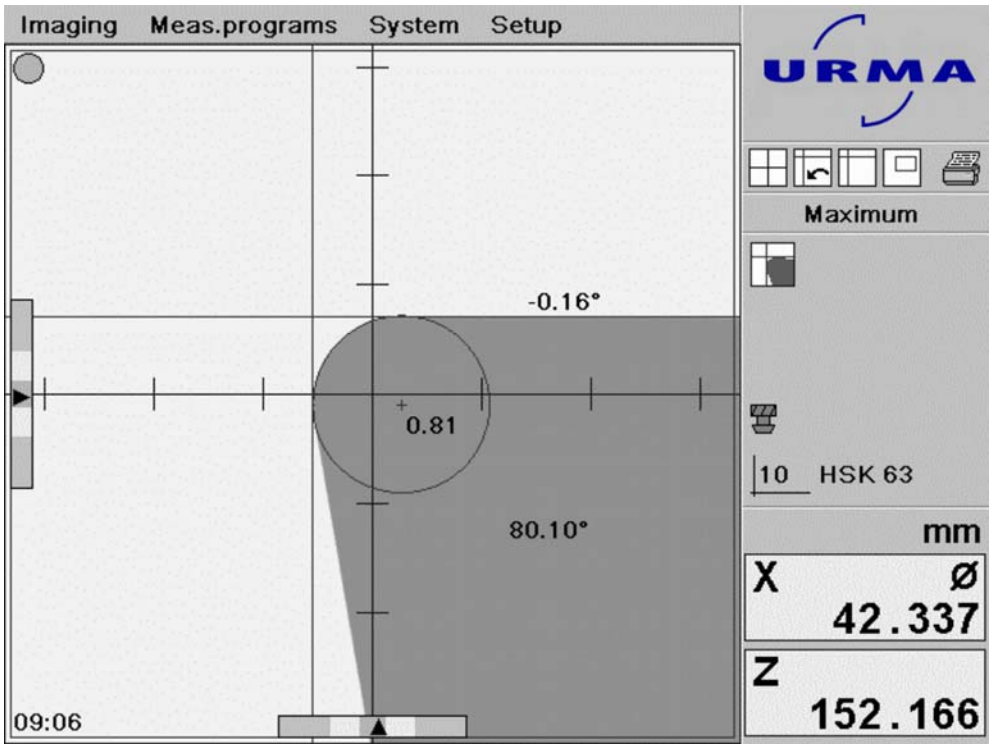

After this, the system stays in the measure centre mode and you can check the measurements of the master mandrel.

You should measure the engraved values of the master mandrel

# 5 Commissioning

## 5.1 Operating Digiset 5

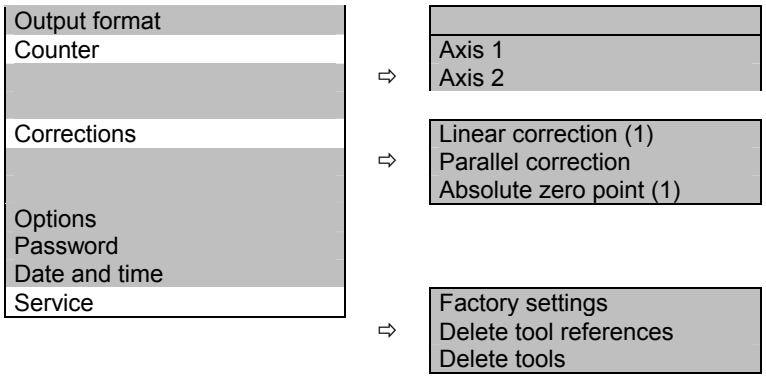
In operational mode the 10.4" colour screen is divided into three sections. The menu bar is at the top of the screen. Below this, in the largest area of the screen, the live picture of the object to be measured is displayed with cross hairs and various setting aids. On the right hand side of the screen a large area with status and system information (status field) extends the whole height of the screen.



### 5.1.1 Menu bar (Main menu)

The menu bar represents the Digiset 5 main menu. There are up to two submeus. Each required operating mode can be selected very quickly by clicking the left mouse button. If a function contains a further menu (sub-menu), this is shown by an arrow.

| ain menu | | Sub-menu 1 | | Sub-menu 2 |
|---|---|---|---|---|
| Imaging | ⇨ | Fixed axis | | |
| | | Maximum | | |
| | | Preset | | |
| | | Measure centre | | |
| | | Range | | |
| | | Measure method | ⇨ | M0: Automatic<br>M1: L1<br>M2: L2<br>M3: PX<br>M4: PZ<br>M5: L1-PX<br>M6: L2-PX<br>M7: L1-PZ<br>M8: L2-PZ<br>M9: L1-L2<br>M10: L1-L2-PX<br>M11: L1-L2-PZ<br>M12: PX-PZ |
| Meas. programs | ⇨ | Line | | |
| | | Angle | | |
| | | Radius | | |
| | | With Measure centre | | |
| System | ⇨ | Select tool reference | | |
| | | Manage tool references | ⇨ | New<br>Delete<br>Change<br>Show list |
| | | Select tool | | |
| | | Deselect tool | | |
| | | Manage tools | ⇨ | New<br>Delete<br>Change<br>Show list |
| | | Tool list | | |
| | | PP-measurement series (1) | ⇨ | New<br>Cancel<br>Interrupt<br>Continue<br>Output<br>Show list |
| Setup | ⇨ | Info | | |
| | | Imaging | ⇨ | Align camera<br>Illumination<br>Coordinate system (1)<br>Black/White<br>Brightness (1)<br>Inverse tool<br>Parameter |
| **Main menu** | | **Sub-menu 1** | | **Sub-menu 2** |
| | | Interface | | |




### 5.1.2 Live picture

The object to be measured and the various adjustment aids depending on the operating mode (cross hairs, adjustment bars, test LED, measuring lines, analysis window, measuring results) are displayed on the live picture operating mode.

#### 5.1.2.1 Cross hairs

The cross hairs give an overview of the position of the contour.

In the "Fixed axis" operating mode the measurements always refer to these cross hairs with the origin at 0.0 mm or inches. In the "Preset" and "Maximum" operating modes these cross hairs remain so that the tool reference for the whole measuring structure is retained. Additional red measuring lines are created on the object's profile depending on the measuring method determined or selected.

#### 5.1.2.2 Adjustment bars

Adjustment bars are provided for both directions in the "Fixed axis" operating mode. The pointer in the X adjustment bar gives the contour's positive or negative deviation from the measuring line in the X direction, the Z adjustment bar does the same in the Z direction. The different colours on the bar show the distance of the contour from the measuring line.

The different setting ranges have the following limits:

| Colour | Setting range |
|---|---|
| Grey | ± (16 – 60) µm |
| Yellow | ± (4 -15) µm |
| Green | ± (0 -3) µm |

#### 5.1.2.3 Test LED

The test LED indicates whether the TCAM2 can correctly apply one of the implemented measurement functions to the object displayed.

- If no measurement functions can be carried out correctly,
  the test LED will be **red.**
  Then the data cannot be analysed or further processed by the user.
- If the measurement can be carried out correctly,
  the test LED will be **green**.

### 5.1.2.4 Measuring lines

The auxiliary lines determined by the TCAM2 using the object to be measured are marked as measuring lines. They are shown in red.

In the "Fixed axis" operating mode the contour of the object must be aligned to these. In the "Maximum" and "Preset" operating modes the measuring lines are attached to the object.

The cross hair axes can also be shown in red as a measuring line if the selected measuring function requires this, for example for point measuring with the "Fixed axis" operating mode.

### 5.1.2.5 Analysis window

The analysis window is displayed as a square edged in red. It marks the area where the TCAM2 carries out contour measurements so that the most interesting area can be selected even with objects that have complex contours.

The size of the analysis window can be changed as required. After selecting the "Range" operating mode, a new analysis window can be created by clicking anywhere in the live picture.

You access this operating mode using the following menu steps:

| **Main menu** | | **Sub-menu 1** |
|---|---|---|
| Imaging | ⇨ | Range |

When the contour of the object to be measured is clear (line - radius - line) select the whole object field as the analysis window. If several edges or complex contours are visible, restrict the analysis window.

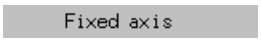
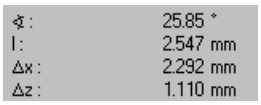
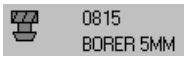
### 5.1.2.6 Measuring results

The measuring results calculated will be displayed on the corresponding position of the object depending on the measuring programs selected, such as line, angle, radius etc.

If a radius is detected when analysing an object contour, this will be shown as a red circle and the length of the radius shown in the circle. If the radius on the object contour is smaller than 0.3 mm or larger than 20 mm this value will not be shown.

## 5.2 Status field

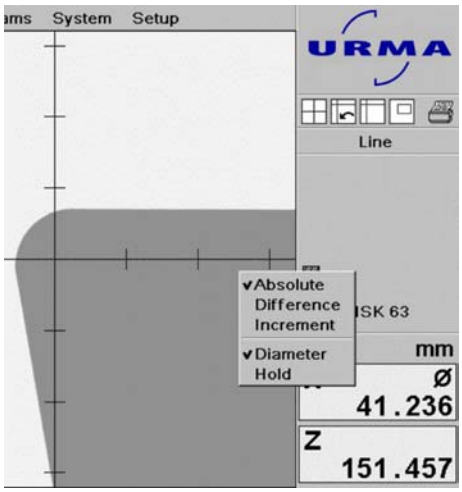
### 5.2.1 Status and system information

| Display | Description |
|---|---|
| | Upper toolbar for selecting important operating modes directly and quickly using tool buttons. |
|  | Current operating mode display (status). |
|  | Measuring program results display (e.g. line). |
| | Selected measuring method display e.g. M3: PX.<br>One of the possible measuring methods can be selected after the contour analysis by clicking on the icon. |
|  | Tool icon with the identity number and name of the selected tool shown in clear text.<br>The stored tools can be displayed directly by clicking on the tool icon. |
| | Tool reference symbol with tool reference number and the name of the tool reference in clear text.<br>The tool references created can be displayed directly by clicking on the tool reference icon. |
| | Display of the selected measuring unit (mm/inch)<br>You can switch to the other measuring unit by clicking on the display. |
| <br> | Display of the X and Z readings in absolute display mode if a counter module is connected.<br>The hold function for the corresponding axis can be switched on by clicking on the display fields. |

### 5.2.2 Various methods of displaying readings on the TCAM2

You access this operating mode using the right bottom of the mouse. You position the cursor either in the counter field of X or Z-axis and press the eight bottom on the mouse.

The window with the methods of displaying will Open.




You can change the attributes for each axis separately.

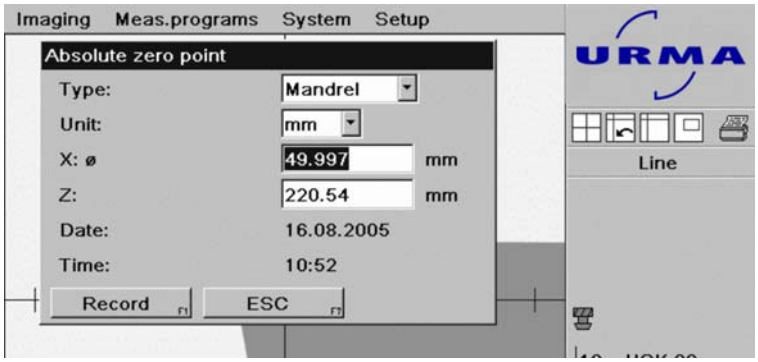
- Absolute — Current counter value relating to the selected tool reference.
- Difference — Current counter value relating to the selected tool reference **including** nominal values.
- Increment — The reading is reset to 0.000.
- Diameter — The current reading is doubled.
- Hold — The hold function (counter stop function) is switched on. The counter analysis continues to work in the background.

As the following examples show, the different display modes can be shown combined with each other:

| | |
|---|---|
| X Δ Ø 8.954 | Display of the X reading with additional information<br>Δ Difference display<br>Ø Diameter display<br>red Display with hold function set (counter stop). |
| Z ⏩ 0.000 | Display of the Z reading in increment mode. |

## 5.3 **Input by keyboard**

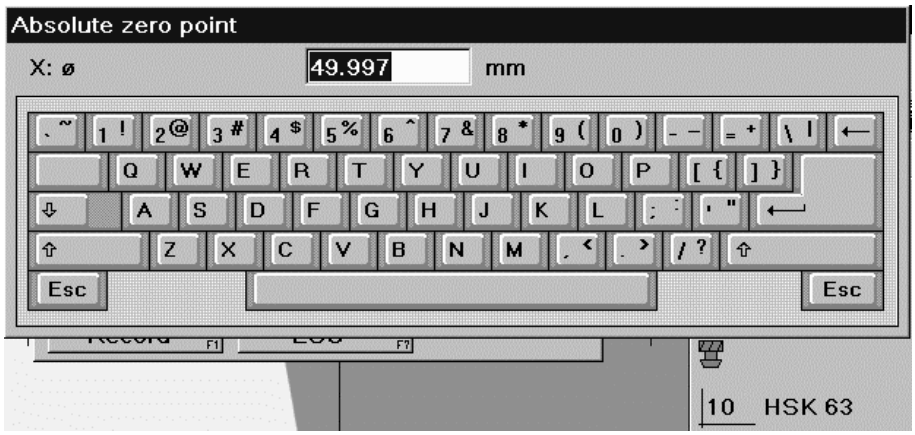
The TCAM2 has no keyboard . If you have to enter alphanumerical strings in An entering field, than you have to position the cursor on this field and you press The right bottom of your mouse.




Example set absolute zero point

When the cursor is set to the field X ( white digits in a blue field) You press the right bottom on your Mouse

It will open a window with the keyboard




With the cursor you can now klick on the bottoms of the keyboard and in this way enter the alphanumerical strings.

When you press ENTER the string will be written to the entering field and the key-board will be closed.

# 6 Configuration (software setup)

## 6.1 Info

You access this operating mode using the following menu steps:

| Main menu | | Sub-menu 1 |
|---|---|---|
| Setup | ⇨ | Info |

The info window gives you the current system information and you can license software extensions that need to be paid for by entering a new licence number.

Make sure you don’t lose the licence number!

If you lose the licence number the system can no longer be operated. In this case, please contact the manufacturer on +41-62-889 2020 or info@urma.ch

If you buy a software update, you will receive a new licence number with the software extension that must be entered.

## 6.2 Imaging

### 6.2.1 Coordinate system (optional)

The names of the vertical and horizontal axes often vary with measuring instruments. And so vertical and horizontal adjustment devices also differ in their axis assignment for example.

This operating mode is therefore used for the axis assignment (X = horizontal or vertical, Z = vertical or horizontal) including the imaging axes with the counter module axes.

You access this operating mode using the following menu steps:

| Main menu | | Sub-menu 1 | | Sub-menu 2 |
|---|---|---|---|---|
| Setup | ⇨ | Imaging | ⇨ | Coordinate system |

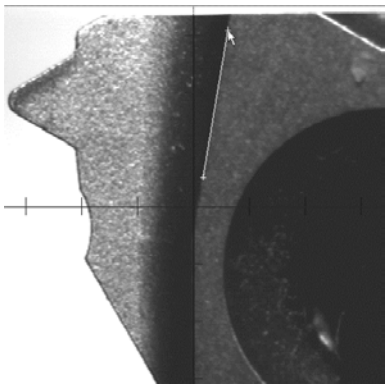
### 6.2.2 Black/White

You access this operating mode using the following menu steps:

| Main menu | | Sub-menu 1 | | Sub-menu 2 |
|---|---|---|---|---|
| Setup | ⇨ | Imaging | ⇨ | Black/White |

Here you can decide whether an object and its contour are displayed in colour (false colours) or in black and white (grey scale).

The standard setting with false colours is used for the **transmitted light application.** It gives optimum optical contrast for your observations and is the basis for precise measuring results.



*Tool cutting edge in incident light*

**Incident applications,** such as cutting inspections, are carried out in the Black/White setting because with this the user can check the surface of the object visually very easily for any damage.

You can use the "Line" and "Radius" measurement function to analyse edges on the surface of an object very well geometrically.

### 6.2.3 Brightness (optional)

In the "Black/White" operating mode the "Brightness" function is used to adjust the brightness of the live picture.

You access this operating mode using the following menu steps:

| Main menu | | Sub-menu 1 | | Sub-menu 2 |
|---|---|---|---|---|
| Setup | ⇨ | Imaging | ⇨ | Brightness |

You also can start the "Brightness" function by right clicking (context menu) when the mouse pointer is placed on the live picture.

### 6.2.4 Inverse tool

You access this operating mode using the following menu steps:

| Main menu | | Sub-menu 1 | | Sub-menu 2 |
|---|---|---|---|---|
| Setup | ⇨ | Imaging | ⇨ | Inverse tool |

This menu item works as a toggle function and changes the setting of a normal tool with cuts outwards to an "inverse tool" with cuts inwards, such as is the case with bell tools. The "Inverse tool" setting only works with the "Maximum" measuring method.

### 6.2.5 Imaging parameters

You access this operating mode using the following menu steps:

| Main menu | | Sub-menu 1 | | Sub-menu 2 |
|---|---|---|---|---|
| Setup | ⇨ | Imaging | ⇨ | Parameter |

The following parameters can be set using the rough setting slider.

- Line length
- Line deviation
- Radius deviation

The object to be measured must be moved until it is in camera range.

#### 6.2.5.1 Line length

You use line length to set how long a line must be before it is detected by TCAM2 as a line.

The sensitivity can be varied from 0.000 mm to 3,000 mm.
The standard setting (default) is 1,020 mm.

#### 6.2.5.2 Line deviation

The line deviation parameter gives the maximum permissible deviation of the edge values from the ideal shape of the line.

The deviation can be varied from 0 µm to 100 µm.
The standard setting (default) is 20 µm.

#### 6.2.5.3 Radius deviation

The radius deviation parameter gives the maximum permissible deviation of the edge values from the ideal shape of the circle.

The deviation can be varied from 0 µm to 100 µm.
The standard setting (default) is 45 µm.

## 6.3 Serial interface (counter module)

You access this operating mode using the following menu steps:

| Main menu | | Sub-menu 1 |
|---|---|---|
| Setup | ⇨ | Interface |

Here you can configure the counter module's serial interface for data output.

The serial interface on Digiset 5 is only meant for data transfer between the TCAM2 and the counter module.
It cannot be configured.

## 6.4 Output format

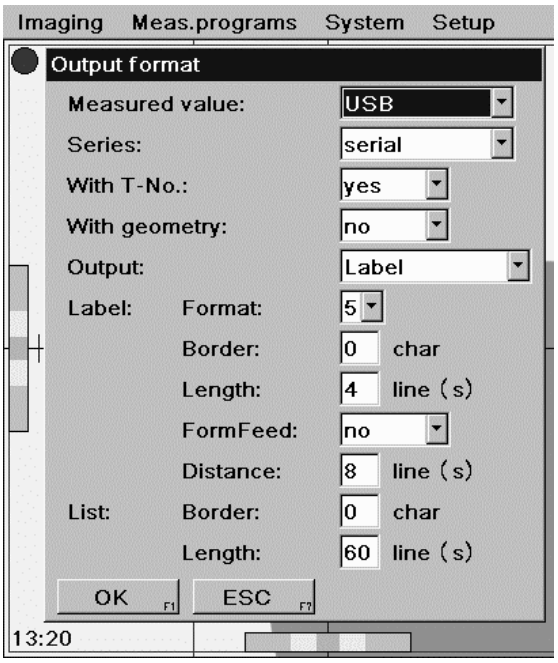
You access this operating mode using the following menu steps:

| Main menu | | Sub-menu 1 |
|---|---|---|
| Setup | ⇨ | Output format |

Here you define the interface for an output and the corresponding formats for labels or lists.

For labels the required format can also be selected from a format template catalogue.

Digiset 5 has  a serial interface and a standard a USB port.




In this window you define the interface for an output and the corresponding formats for labels or lists.

For labels the required format can also be selected from a format template catalogue.

The USB port is available as a special fitting in addition to the serial and parallel ports.

Measured value:
Output of the measured values of one tool

Series:
Output of a list of measured values of dif ferent tools format template catalogue

For the two printers of our product program you will find the format template in the following list.

| | | Seikosha SP 2400 Matrixprinter | DYMO 310 Thermoprinter |
|---|---|---|---|
| **Label** | **Format** | **5** | **3** |
| | **Border** | **1** | **0** |
| | **Length** | **4** | **5** |
| | **Form Feed** | **No** | **yes** |
| | **Distance** | **8** | **0** |

## 6.5 Measuring systems

It is possible to configure all signal inputs separately.
The third axis (Axis 3) is optionally.

You access these operating modes using the following menu steps:

| Main menu | | Sub-menu 1 | | Sub-menu 2 |
|---|---|---|---|---|
| Setup | ⇨ | Counter | ⇨ | Axis 1<br>Axis 2<br>Axis 3 |

Parameters that must be entered to configure a measuring system entry in the fields provided for it depend on the measuring systems connected.

## 6.6 Corrections

### 6.6.1 Linear correction (optional)

You access this operating mode using the following menu steps:

| Main menu | | Sub-menu 1 | | Sub-menu 2 |
|---|---|---|---|---|
| Setup | ⇨ | Corrections | ⇨ | Linear correction |

Correction values can be calculated in the "Linear correction" operating mode using target and actual value comparisons and then automatically taken into consideration in every measurement.
This correction value is calculated using end measurements (=nominal value).
Each axis can be given a correction value.

### 6.6.2 Parallel correction

You access this operating mode using the following menu steps:

| Main menu | | Sub-menu 1 | | Sub-menu 2 |
|---|---|---|---|---|
| Setup | ⇨ | Corrections | ⇨ | Parallel correction |

The axis of the calculated correction values is automatically allocated by the system with parallel correction.

### 6.6.3 Absolute zero point (optional)

You access this operating mode using the following menu steps:

| Main menu | | Sub-menu 1 | | Sub-menu 2 |
|---|---|---|---|---|
| Setup | ⇨ | Corrections | ⇨ | Absolute zero point |

The absolute zero point is the reference point for all stored tool references.
For this reason, before saving tool references, it is necessary to store the absolute zero point as follows.

Procedure:
Select the "Absolute zero point" operating mode.

☞ 1. Enter the known dimensions of the setting pin.

2. Move the two measuring points in X and Z in any order and confirm the relevant positions by pressing the <Record > key.

3. After accepting the two measuring points the TCAM2 is in the "Measure centre" operating mode with 0 as the tool reference so that the measurement on the calibration pin and thus the correct recording of the absolute zero point can be checked.

The order of recording the measuring point doesn't matter because Digiset 5 carries out the allocation by itself.

## 6.7 Options

This operating mode gives you the option of setting specific system settings so that they are automatically selected even after the system is restarted.
You access this operating mode using the following menu steps:

| Main menu | | Sub-menu 1 |
|---|---|---|
| Setup | ⇨ | Options |

- Angle: Selecting/ deselecting the display of one or more angle values in the TCAM2 live picture.
- Circle: Selecting/ deselecting the display of a circle and the corresponding radius value in the TCAM2 live picture.

  If this is selected any available radius on an object contour is shown as a circle in the object image.
- Measure method: Selecting a standard measuring method. This is activated when starting the TCAM2.
- Language: Selecting one of the loaded language modules.

## 6.8 Password

Important system settings can be protected from unauthorised access by allocating a password.
You access this operating mode using the following menu steps:

| Main menu | | Sub-menu 1 |
|---|---|---|
| Setup | ⇨ | Password |

A password can be allocated or changed. You must enter the password a second time to confirm the first entry.

The following options are available for entering a password:

- none It is not necessary to enter a password when selecting a protected operating mode (factory setting).
- once It is necessary to enter the password when selecting a protected operating mode for the first time. It is not necessary to enter the password again if you select the protected operating modes again because the password is stored until the unit is switched off.
- always It is necessary to enter the password every time you select a protected operating mode.

The password can be entered alphanumerically. You can enter up to 6 characters.

## 6.9 Date and time (optional)

Requirement for this operating mode is the clock module (hardware option), then time indication on the live picture is possible.

Additional possibilities:

- Storing of date and time when entering tool references and corrections.
- Documentation of date and time on measuring output report.

You access this operating mode using the following menu steps:

| Main menu | | Sub-menu 1 |
|---|---|---|
| Setup | ⇨ | Date and time |

## 6.10 Maintenance and service

To maintain the system it is sometimes necessary to load the factory settings (default values) and to delete the tool reference memory or the tool memory completely.

You access the corresponding operating modes using the following menu steps:

| Main menu | | Sub-menu 1 | | Sub-menu 2 |
|---|---|---|---|---|
| Setup | ⇨ | Service | ⇨ | Factory settings<br>Delete tool references<br>Delete tool data |

The 0 tool reference is not deleted when deleting the tool reference memory.

# 7 System

## 7.1 Tool references

The 0 (zero) tool reference is fixed.

Furthermore, the system gives you the option of saving and managing up to 99 more tool references.

### 7.1.1 Select tool references

You access this operating mode using the following menu steps:

| Main menu | | Sub-menu 1 |
|---|---|---|
| System | ⇨ | Select tool reference |

The corresponding tool reference number must be entered and confirmed to select the required tool reference.

### 7.1.2 Manage tool references

This menu item gives you the option of creating and saving new tool references, changing and deleting stored tool references and displaying a list of all tool references.

Before a new tool reference is saved the absolute zero point must be saved.

You access this operating mode using the following menu steps:

| Main menu | | Sub-menu 1 | | Sub-menu 2 |
|---|---|---|---|---|
| System | ⇨ | Manage tool references | ⇨ | New<br>Delete<br>Change<br>Show list |

#### 7.1.2.1 Create new tool references

After selecting the "New" operating mode, a window opens with input fields underlined in white.

After the final confirmation the new tool reference is saved.

### 7.1.2.2 Delete tool references

After selecting the "Delete" operating mode the corresponding tool reference must be selected in the selection window.

There is an additional security query before the tool reference can be deleted after it is confirmed.

The 0 tool reference cannot be deleted.

### 7.1.2.3 Change tool references

After selecting the "Change" operating mode the corresponding tool reference must be selected once more in the selection window.

After confirming that you have found the correct tool reference, a window in which changes can be made opens as it does when entering a new tool reference.

### 7.1.2.4 Show tool reference list

After selecting the "Show list" operating mode, a window opens with a selection list of the saved tool references and the buttons explained below:

| | |
|---|---|
| Select | The tool reference highlighted in the selection list will be loaded. |
| Change | The tool reference highlighted in the selection list can be changed. |
| Delete | The tool reference highlighted in the selection list is deleted after it has been confirmed with the security query. |
| Print list | The tool references will be printed giving the tool reference number and the tool reference name in table form using the interface defined in the "Output format / Measured value" menu item. |
| Close | The tool reference list is closed. |

The 0 tool reference cannot be edited and will therefore not be displayed in the tool reference list.

## 7.2 Tools

The system offers you the opportunity to save and manage up to 1000 tools.

### 7.2.1 Select tool

You access this operating mode using the following menu steps:

| Main menu | | Sub-menu 1 |
|---|---|---|
| System | ⇨ | Select tool |

The corresponding tool identity number (tool ID) must be entered and confirmed to select the required tool.

### 7.2.2 Manage tools

This menu item gives you the option of creating and saving new tools, changing and deleting stored tools and displaying a list of all tools.

You access this operating mode using the following menu steps:

| Main menu | | Sub-menu 1 | | Sub-menu 2 |
|---|---|---|---|---|
| System | ⇨ | Manage tools | ⇨ | New<br>Delete<br>Change<br>Show list |

#### 7.2.2.1 Create new tool

After selecting the "New" operating mode, a window opens with input fields underlined in white.

After the final confirmation the new tool is saved.

Using the playback function the current readings are copied to the input screen as nominal values.

#### 7.2.2.2 Delete tool

After selecting the "Delete" operating mode the corresponding tool must be selected in the selection window.

There is an additional security query before the tool can be deleted after it is confirmed.

#### 7.2.2.3 Change tool

After selecting the "Change" operating mode the corresponding tool must once more be selected in the selection window.

After confirming that the correct tool has been selected, a window in which the changes can be made opens, just as it does when entering a new tool.

#### 7.2.2.4 Show list of tools

After selecting the "Show list" operating mode, a window opens with a selection list of the saved tools and the buttons explained below:

| | |
|---|---|
| Select | The tool highlighted in the selection list will be loaded. |
| Change | The tool highlighted in the selection list can be changed. |
| Delete | The tool highlighted in the selection list is deleted after it has been confirmed with the security query. |
| Print list | The tools will be printed giving the tool ID and tool name in table form using the interface defined in the "Output format / Measured value" menu item. |
| Close | The list of tools is closed. |

## 7.3 Tool list

You access this operating mode using the following menu steps:

| Main menu | | Sub-menu 1 |
|---|---|---|
| System | ⇨ | Tool list |

After selecting this operating mode the measured tools are listed in a window as a table with a consecutive number, information on the tool reference, the T number (tool number) and the tool name. In addition the buttons shown have the following functions:

| | |
|---|---|
| Edit | The entries on the tool selected in the tool list can be changed. |
| New | The tool selected in the tool list will be measured again. |
| Delete | The tool marked in the selection list is deleted after it has been confirmed with the security query. |
| Print list | The tool list will be printed using the interface defined in the "Output format / Series" menu item after a list number has been allocated in another window. |
| Delete all | The whole tool list will be deleted after the security query has been confirmed. |
| Close | The tool list is closed. |

## 7.4 Post processor-measurement series (optional)

You access this operating mode using the following menu steps:

| Main menu | | Sub-menu 1 | | Sub-menu 2 |
|---|---|---|---|---|
| System | ⇨ | PP-measurement series | ⇨ | New<br>Cancel<br>Interrupt<br>Continue<br>Output<br>Show list |

### 7.4.1 New

This operating mode is used to create a measurement range which can be transferred as a controlled output format to a machine. Such a range of measurements can consist of a maximum of 50 data records.

Procedure:

☞ 1. Under the "New" operating mode select the required output format from a list of no more than five stored formats (post processor formats).

2. After selecting the desired output format, the corresponding input mask opens. Enter the logarithm data here. This input mask doesn't have to appear in any case. It depends on the selected post processor.
3. In order to store the measured values for X and Z in a data record, click on the print symbol in the status window.
4. A further input mask opens in which the measured values for X and Z are already entered. Enter any additional PP specific parameters here.
5. Only then can the data record be stored and the measured values printed.

Only one measurement range can be stored.

### 7.4.2 Cancel

The PP measurement range is cancelled. All data records which have been stored so far in the measurement range are deleted.

### 7.4.3 Interrupt

Storing further data records in the PP measurement range is interrupted. All data records which have been stored so far in the measurement range are retained.

### 7.4.4 Continue

The interrupted and stored measurement range continues and further data records are added.

### 7.4.5 Output

The measurement range is transferred as a controlled output format to a machine tool. Either the serial interface (RS232) or the Ethernet effects the transfer.

If several machine tools are connected to an TCAM2 plus and you decide to transfer your data via an RS232, you need an external interface converter.

If you are using the Ethernet you must enter the IP address of the corresponding machine in the TCAM2 plus.

### 7.4.6 Show list

You see a list with all the data that has been stored up till now.

# 8 Imaging

For each measuring procedure ensure that the edges of the object to be measured are not dirty because this could lead to incorrect measuring results.

## 8.1 Starting imaging

After it is switched on the Digiset 5 runs in accordance with the settings made in Options.

The object to be measured must be moved until it is in camera range and the contour of the object, e.g. the tool cutting edge must be focussed sharply by turning the tool on the tool support.

Procedure:

☞ 1. Move the object into the camera's visual range.
2. If the relevant contour of the object is not clear, select the "Range" operating mode and, using the mouse, make it the required size and drag it round the relevant edge.
3. Turning the object to be measured on its support sets the greatest deviation and thus the focus level.
4. While the object is being turned the test LED in the upper left corner turns green as soon as the measurement is correct, i.e. the greatest deviation has been determined. You must ensure here that the turning speed is not too great.

It is vital here that the camera's working distance has been set correctly when commissioning the system (focussing).

If a counter module is connected the system waits for the reference marks of the connected measuring systems to be transferred. The readings taken will be displayed directly after the reference trip.

### 8.1.1 Camera 2 (optional)

You access this operating mode using the following menu steps:

| Main menu | | Sub-menu 1 |
|---|---|---|
| Imaging | ⇨ | 2. Camera |

If a second camera (e.g. incident camera) is used in the imaging system and both cameras are attached to the TCAM2 via a camera switchbox, you can switch over to the other camera using this operating mode.

## 8.2 Measuring methods

### 8.2.1 Fixed axis

Here all measurements relate to the original cross hair co-ordinates.

You access this operating mode using the following menu steps:

| Main menu | | Sub-menu 1 |
|---|---|---|
| Imaging | ⇨ | Fixed axis |

After selection the system analyses the object contour and automatically suggests a measuring procedure for carrying out measurements immediately. The measuring procedure used is displayed in the status window at the same time. If an alternative measuring procedure is required it is possible to enter the measuring procedure manually by pressing the button in the status window.

Procedure:

☞ 6. Move the object into the camera's visual range.
7. Roughly set the picture focus by turning the object on its support to its maximum deviation.
8. As soon as the object to be measured is within the focussing area, the adjustment bars are displayed. The TCAM2 automatically determines the best measuring procedure and the test LED goes green.
9. Move the edge of the object as close as possible to the cross hairs so that the arrow of the adjustment bar corresponding to the deviation direction is in the green area.
10. The focus is finely adjusted by once again turning the object in the direction of the focus level until the arrow shows the maximum deviation in the corresponding adjustment bar.
11. If the TCAM2 does not set the measuring procedure or the analysis window to your requirements, change this manually.
The analysis window should always be around the co-ordinate origin point.
12. Align the contour on the measuring lines. Note the adjustment bars that give you optimum support for this.
13. If the adjustment bar pointers are in the middle you have found the best possible position for the object. You can now further process the data and start measuring again.

### 8.2.2 Maximum

The measuring lines are created on the contour of the object to be measured. Both adjustment bars are hidden. The offset of the measuring lines and the fixed cross hairs in the X and Z direction is taken into account with the current position.

You access this operating mode using the following menu steps:

| Main menu | | Sub-menu 1 |
|---|---|---|
| Imaging | ⇨ | Maximum |

After selection the system analyses the object contour and automatically suggests a measuring procedure for carrying out the measurements immediately. The measuring procedure used is displayed in the status window at the same time. If an alternative measuring method is required it is possible to enter the measuring procedure manually by pressing the button.

Procedure:

☞ 1. Move the object into the camera's visual range.
2. If the relevant contour of the object is not clear, select the "Range" operating mode and, using the mouse, make it the required size and drag it round the relevant edge.
3. Select the operating mode as described above.
4. Turning the object to be measured on its support sets the greatest deviation.
5. While the object is being turned the test LED turns green as soon as the measurement is correct, i.e. the greatest deviation has been determined. You must ensure here that the turning speed is not too great. When the measurement has been made correctly the offset values are saved and transferred through the serial port.
6. If the object is set to a specific size, the object must be moved again to the greatest deviation position so that the arrow of the adjustment bar corresponding to the deviation direction is in the green area again.
7. Then the unit switches to the "Preset" measuring method.

### 8.2.3 Preset

The measuring lines are created on the contour of the object to be measured. Both adjustment bars are hidden. The offset of the measuring lines and the fixed cross hairs in the X and Z direction is taken into account with the current position.

You access this operating mode using the following menu steps:

| Main menu | | Sub-menu 1 |
|---|---|---|
| Imaging | ⇨ | Preset |

After selection the system analyses the object contour and automatically suggests a measuring procedure for carrying out the measurements immediately. The measuring procedure used is displayed in the status window at the same time. If an alternative measuring method is required it is possible to enter the measuring procedure manually by pressing the button.

Procedure:

☞ 1. Move the object into the camera's visual range.
2. If the relevant contour of the object is not clear, select the "Range" operating mode and, using the mouse, make it the required size and drag it round the relevant edge.
3. Select the operating mode as described above.
4. Digiset 5 automatically determines the best measuring procedure and the test LED goes green. Depending on the measuring procedure selected measuring lines are created on the object's contour.
5. The object to be measured can now be set to the required size taking note of the reading.
6. If the TCAM2 does not set the measuring procedure to your requirements, change this manually.

The object to be measured must be in the camera's focussing area.

### 8.2.4 Measure centre

Here the TCAM2 determines the edge pixel next to the cross hair origin point. This is done using the pointers in the adjustment bars that should, ideally, both be in the middle. The edge point is next to the cross hair origin point when both pointers are in the middle of the green area.

You access this operating mode using the following menu steps:

| Main menu | | Sub-menu 1 |
|---|---|---|
| Imaging | ⇨ | Measure centre |

Selecting this measuring method is recommended when carrying out the following setup settings because any dust and dirt residue on the object to be measured, e.g. gauge (calibrating mandrel or ball gauge), will not affect the measuring results.

- Parallel correction
- Absolute zero point

## 8.3 Measuring procedures

### 8.3.1 Principal procedures in contour analysis

Digiset 5 has two main measuring procedures that are used for analysing an object contour.

- Point measurement
- Line or angle measurement

#### 8.3.1.1 Point measurement

Point measurement determines the highest deviation value in the corresponding axis.

This is done in the "Fixed axis" measuring method by moving the object to be measured to the corresponding cross hairs axis so that the adjustment bar pointer is in the green area.

In the "Maximum" and "Preset" measuring methods Digiset 5 automatically calculates the highest deviation position and creates the red measuring lines vertically or horizontally.

#### 8.3.1.2 Line or angle measurement

Line measurement determines and analyses one or more of the object's straight contour sections.

In the "Fixed axis" measuring method, red lines which pass through the cross hairs origin point are drawn parallel to these contour sections and their angles to the cross hairs displayed. The distance of the object to be measured from the red measuring line(s) is indicated by the adjustment bar pointers.

In the "Maximum" and "Preset" measuring methods the red measuring lines are placed directly above the object's straight contour sections. The imaging results and the current position of the optical equipment carrier are taken into account together.

### 8.3.2 Detailed description of measuring procedures

12 detailed measuring procedures have been developed from the main measuring procedures. Digiset 5 uses these to analyse contours.
The number of different measuring possibilities is, of course, significantly higher because the measuring procedure can be carried out in each individual quadrant.

You access this operating mode using the following menu steps:

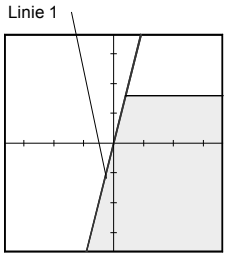
| Main menu | | Sub-menu 1 | | Sub-menu 2 |
|---|---|---|---|---|
| Imaging | ⇨ | Measure method | ⇨ | M0: Automatic<br>M1: L1<br>M2: L2<br>M3: PX<br>M4: PZ<br>M5: L1-PX<br>M6: L2-PX<br>M7: L1-PZ<br>M8: L2-PZ<br>M9: L1-L2<br>M10: L1-L2-PX<br>M11: L1-L2-PZ<br>M12: PX-PZ |

| Procedure | Brief explanation |
|---|---|
| • M0: Automatic | The procedure used is determined by the TCAM2 |
| • M1: L1 | Line 1 measurement |
| • M2: L2 | Line 2 measurement |
| • M3: PX | Point X measurement |
| • M4: PZ | Point Z measurement |
| • M5: L1-PX | Line 1 and point X measurement |
| • M6: L2-PX | Line 2 and point X measurement |
| • M7: L1-PZ | Line 1 and point Z measurement |
| • M8: L2-PZ | Line 2 and point Z measurement |
| • M9: L1-L2 | Line 1 and line 2 measurement |
| • M10: L1-L2-PX | Line 1 and line 2 and point X measurement |
| • M11: L1-L2-PZ | Line 1 and line 2 and point Z measurement |
| • M12: PX-PZ | Point X and point Z measurement |

When fixing the line and angle markings light/dark borders are seen going counter-clockwise from the positive X axis. Line 1 is shown as the light to dark border within the analysis window. Line 2 is set as the dark to light border.

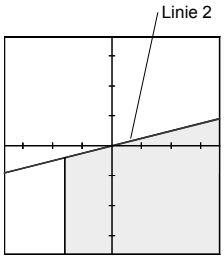
If Digiset 5 cannot use any of the measuring procedures for the contour detected, the test LED in the upper left corner of the screen will be **red.** The measuring results are then incorrect! .

### 8.3.2.1 "Line 1" measurement (L1)



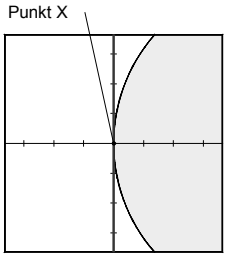

Line 1 is determined.
(Light to dark border counter clockwise within the analysis window)

### 8.3.2.2 "Line 2" measurement (L2)



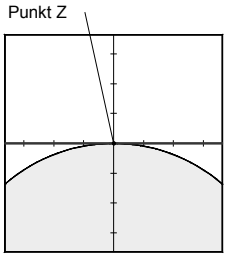

Line 2 is determined.
(Dark to light border counter clockwise within the analysis window)

### 8.3.2.3 "Point X" measurement (PX)



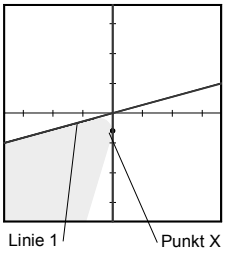

The maximum X deviation is determined.

### 8.3.2.4 "Point Z" measurement (PZ)




The maximum Z deviation is determined.

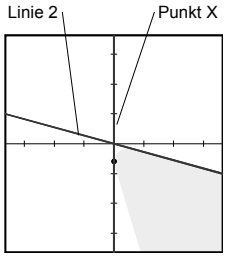
### 8.3.2.5 "Line 1 - Point X" measurement (L1 - PX)




The vertical axis is touched at one point and shown as a red measuring line. Line 1 runs through the cross hairs origin point.

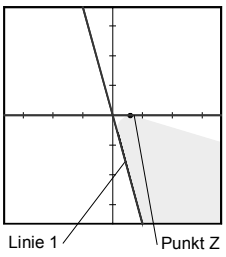
The contour is aligned to its optimum level when the pointers on both adjustment bars are exactly in the middle.

### 8.3.2.6 "Line 2 - Point X" measurement (L2 - PX)



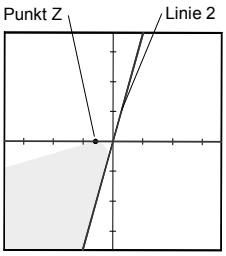

The maximum X deviation and line 2 are determined. The results then show the intersection point.

### 8.3.2.7 "Line 1 - Point Z" measurement (L1 - PZ)




The maximum Z deviation and line 1 are determined. The results then show the intersection point.

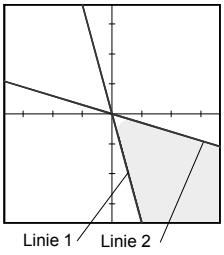
### 8.3.2.8 "Line 2 - Point Z" measurement (L2 - PZ)




The horizontal axis is touched at one point and shown as a red measuring line. Line 2 runs through the cross hairs origin point.

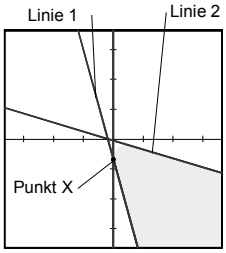
The contour is aligned to its optimum level when the pointers on both adjustment bars are exactly in the middle.

### 8.3.2.9 "Line 1 -Line 2" measurement (L1 - L2)




The intersection point of both measuring lines (line 1 and line 2) is determined.

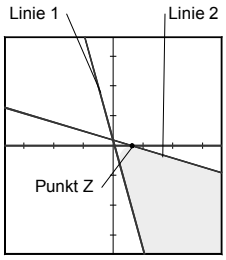
### 8.3.2.10 "Line 1 - Line 2 - Point X" measurement (L1 - L2 - PX)




The vertical axis is touched at one point and shown as a red measuring line. The intersection point of the two other measuring lines is on the horizontal axis.

The contour is aligned to its optimum level when the pointers on both adjustment bars are exactly in the middle.

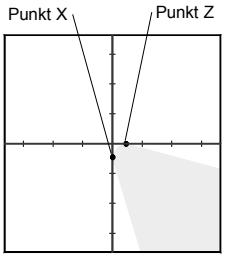
### 8.3.2.11 "Line 1 - Line 2 - Point Z" measurement (L1 - L2 - PZ)




The horizontal axis is touched at one point and shown as a red measuring line. The intersection point of the two other measuring lines is on the vertical axis.

The contour is aligned to its optimum level when the pointers on both adjustment bars are exactly in the middle.

### 8.3.2.12 "Point X - Point Z" measurement (P1 - PZ)




The horizontal and vertical axes are touched at one point and shown as red measuring lines.

The contour is aligned to its optimum level when the pointers on both adjustment bars are exactly in the middle.

## 8.4 Measuring programs / Measuring functions

You access this operating mode with the "Measuring programs" menu item in the main menu:

| Main menu | | Sub-menu 1 |
|---|---|---|
| Meas. Programs | ⇨ | Line<br>Angle<br>Radius<br>With measure centre |

These measuring functions must be used regardless of the possible settings in "Measure method".

### 8.4.1 Line

The "Line" measurement function is used to measure a line visually from point to point. If the TCAM2 finds an edge near the selected point, the next edge pixel will be taken as the display and analysis point. If there is no edge nearby, the precise position of the mouse pointer will be taken.

Procedure:

☞ 1. Select "Line".

2. Move the mouse pointer to the desired position and left click. The TCAM2 sets the first analysis point on the next edge pixel.

3. Move the mouse pointer to the next position and left click. The TCAM2 sets the second analysis point on the next edge pixel. The function is now closed and angle, length and the orthogonal $\Delta x$ and $\Delta z$ difference of the line are displayed in the status window.

The first analysis point is the origin point for calculating the angle while the second analysis point marks the end of the line whose angle is calculated on the horizontal axis.

### 8.4.2 Angle

The "Angle" measurement function is used to measure visually the angle between two lines. Here too the next edge pixel is taken as the display and analysis point.

Procedure:

☞ 1. Select "Angle".
2. Move the mouse pointer to the required position and by clicking on two points on each line, mark the two lines where the angle is to be determined.
3. By clicking on the last point the angle is calculated and displayed in the status window together with the intersection point co-ordinates, x0 and z0, for both lines.
4. Complementary or corresponding angles can be displayed using the <F6> key.

### 8.4.3 Radius

The "Radius" measurement function is used to measure visually a circle or radius from 3 points. Here too the TCAM2 looks for the next edge pixel as an analysis point.

Procedure:

☞ 1. Select "Radius".
2. Move the mouse pointer to the desired position and left click. The TCAM2 sets the first analysis point here.
3. Move the mouse pointer to the desired position and left click. The TCAM2 sets the second analysis point here.
4. Move the mouse pointer to the desired position and left click. The TCAM2 sets the third analysis point here and draws the circle calculated directly. The radius and the x and z co-ordinates of the centre of the circle (x0, z0) can be seen in the status window.

By moving the optical equipment carrier along an object contour it is possible to measure larger radii too.

### 8.4.4 With measure centre

In the line, angle, radius, perpendicular measurement programs etc. the measuring points are marked by default with the mouse pointer. The "With measure centre" operating mode enables you to define these measuring points with the original cross hair co-ordinates.

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# 10 Appendix 1 / Password

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Password/ Factory setting